THE GEOLOGY OF THE VENERA 8 LANDING SITE; Alexander T. Basilevsky;
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Introduction. Gamma spectrometric analysis of the Venera 8 material showed on relatively high contents of K (4%), U (2.2 ppm), and Th (6.5 ppm). This material was interpreted to be either alkaline basalt (e.g. such as the Venera 13 basalt) or some more evolved subalkaline and alkaline intermediate rock (e.g. andesite or trachyte) [1,2,8,9]. A study of correlation between the geochemistry measured by the landers and geology seen in the Magellan imagery, done at the initial stage of the Magellan data analysis [2,12], showed that at the five sites where a tholeitic composition was measured (Venera 9, 10, 14, Vega 1, 2) the volcanic plains with morphology suggestive of the low viscosity lavas were observed. At the Venera 8 and 13 sites, where non-tholeitic high-K compositions were measured, the volcanic plains were also dominating. But among the plains the steep-sided volcanic domes, indicative on high-viscosity lava eruption, were found that was considered as an evidence of specific petrogenesis in these areas.

Later analysis of the Magellan data led to significantly better understanding of many aspects of Venus geology. In particular, the observed geologic formations were subdivided into several morphologic varieties which showed consistent age relations in a broad regional and even global scale that led to suggestion of a model of regional and global stratigraphy of Venus [3,4]. This arises a question about the stratigraphic positions of the materials analysed by the Venera/Vega landers though the model itself is now in the process of testing. This work is aimed to answer through the photogeologic analysis of the Magellan images of the Venera 8 site: 1) Whether the local stratigraphic column consists (or not) of obvious correlatives of the units of the suggested stratigraphy model [3,4] thus testing the model for the Venera 8 site; and 2) Which of the geologic units may represent the material sampled by this lander.

Observations. Venera 8 landed at the Navka Planitia. The landing circle, 300 km in diameter, is centered at 10.70oS, 335.25oE. The present study is based on the analysis and mapping of two C1-MIDRPs (15S335 and 00N335) and several F-MIDRPs of this area. Ten rock-stratigrapic units were identified and mapped, all except one are correlative to the units suggested by [3,4]. From older to younger they are: 1) Tessera terrain material (Tt) forms several islands of a few tens km across embayed by the surrounding plains; occupies ~ 0.15% of the area under study. 2) Material of the densily fractured plains (Pdf) forms low kipukas (~1% of the area). 3) Material of fractured and ridged plains (Pfr) composes remnants of the belts of relatively wide (3-5 km) linear ridges; (~1.5%). 4) Material of shield plains (Psh) consisting of coalescing gentle-sloped volcanic shields of 1-3 to 15-20 km across (~10%). Several steep-sided domes of 10 to 25 km in diameter, including one in the Venera 8 landing circle, are part of the Psh unit. The following units 5, 6, and 7 are evidently the local varieties of plains with wrinkle ridges (Pwr) widely distibuted along the Venus surface [3,4]: 5) Material of mottled plains with intermediate radar backscatter (Pwr-m; ~ 55%). 6) Material of radar dark homogenious plains (Pwr-d; ~30%). 7) Material of the radar-bright homogenious plains (Pwr-b; ~1%). 8) Material of radar-dark gently sloping shields which appearance, resembling an amoeba, was a ground for [7] to name them "amoeboids"(Pda; ~1%); this unit is absent in the model of [3,4]. 9) Material of lobate relatively bright plains (Pl-b; ~0.1%). 10) Material of impact craters including their ejecta and outflows (Cu); occupies on total about 0.3% of the area.

Discussion. The geology of the area under study has many common themes with the geologies of other regiones of Venus and simultaneously it has a specifics. The main common theme is that all except one (Pda) geologic units of the area have their correlatives with geologic units of majority of other studied regiones. It means that geologic processes in the Venera 8 area and their sequence in time (in relative sense) were mostly the same as in the majority of other studied regiones of Venus. This supports the validity of the stratigraphy model by [3,4] which however continues to be a model which needs further tests.

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A specifics of the area under study consists mostly in a higher than usual abundance of the shield plains (Psh) and in the presence of so-called amoeboids (Pda) which are also shields. Within the landing circle this specifics is even more prominent: the shield plains occupy about 35% and amoeboids, about 6% of the area. So if to search a cause of the measured enrichment of the Venera 8 material in K, U, and Th in specifics of the geology of the landing site we should pay a special attention on the shield plains and on the amoeboids which are related formations in sense that both of them are made of small volcanic shields. This gives us a ground to think that Venera 8 could sample either the Psh material or the Pda one. This conclusion is supported by the fact that small volcanic shields are present in another site where non-tholeitic composition was measured (Venera 13) and they are not typical for the sites where tholeitic compositions were measured (Venera 9, 10, 14, Vega 1 and 2) [2,12].

It is not clear how abundance of the landing circle in the shield fields can be related to the enrichment of the Venera 8 material in K, U, and Th which are typical incompatible elements. Some terrestrial volcanic fields, for example volcanic fields of Colorado Plateau, which are considered by [6] as possible analog of the venusian small shield fields, show a petrologic diversity from tholeites through alkali-olivine basalts and hawaiites to mugearites and trachytes (see for example [5]. Two other terrestrial volcanic environments were considered as morphological analogs of the venusian shield fields by [10]: 1) shield volcanoes of the Iceland type and 2) lava domes of the East Pacific rise. First of them, which geodynamicaly is a superposition of hot spot on the mid-oceanic rise, shows a presence of not only low-K basalts but high-K rocks too. The second one is dominated by the low-K basalts. But in some cases of possible hot-spot influence the varieties enriched in incompatible elements are also observed. The questions which terrestrial environment is the best analog of the venusian shield fields, if any, and what is a petrological sense of the possible link between the enrichment of the Venera 8 material in K, U, and Th and abundance of the shield fields in the landing circle demands more studies.

Conclusions. Photogeologic analysis and mapping of the Magellan images of the Venera 8 landing site showed that the geologic units of this area and their relative sequence in time are mostly the same as those suggested by the regional and global stratigraphy model of [3,4). In the landing circle the anomalously high abundance of fields of small volcanic shields belonging to shield plains (Psh) and to amoeboid plains (Pda) was found. This and comparisons with the geologies of other Venera/Vega sites give grounds to think that the material sampled by the Venera 8 represents either shield plains or amoeboids and that other localities of the shield fields on Venus may also be the sites of high-K non-tholeitic materials on this planet. The implication of the latter is that the Venera 8 landing site should be considered as one of the potential targets for future missions to Venus having a possibility to study the surface geochemistry of different geologic units.

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